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MANUAL OF INSTRUCTION

IN

ORDNANCE AND GUNNERY

FOR THE

U. S. NAVAL TRAINING SERVICE

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DEPARTMENT OF THE NAVY,
BUREAU OF NAVIGATION,
WASHINGTON, D. C., *October 30, 1900.*

This text-book, arranged for publication under the direction of Commander J. J. Hunker, Commandant of the U. S. Naval Training Station, Newport, R. I., by Lieutenant C. L. Hussey, U. S. Navy, and Lieutenant R. H. Osborn, U. S. Navy, is approved, and its use at U. S. Naval Training Stations, on board U. S. Training Ships, and on board such other United States vessels as it may be found useful, is authorized.

A. S. CROWNINSHIELD,
Chief of Bureau.

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MANUAL

OF

INSTRUCTION IN ORDNANCE AND GUNNERY.

GENERAL INSTRUCTIONS.

Gunnery Instructors must carefully familiarize themselves with the following details, which have been prepared with the view of obtaining uniformity and thoroughness in the course of instruction of apprentices in gunnery. These details must be carried out in every particular as laid down, and, when this is impracticable, or there is doubt as to the meaning of any part of them, the officer in charge of the gunnery branch should be consulted immediately. During drill periods, when not detailed for other duty, it is expected that the instructors will take advantage of the opportunity for perfecting themselves in the various drills and exercises.

The Number of Apprentices assigned to one instructor must be as small as practicable, and, if possible, should not exceed twenty-five. When general instruction is given to a whole class all the instructors must be present to assist as may be necessary, unless excused from this duty by the officer in charge of the gunnery department.

Preparation.—Before the drill call is sounded instructors should see that such material as may be needed for the instruction or drill is provided or ready for use.

Arms and Ammunition.—Apprentices should not be permitted to use any part of the ordnance outfit until they have been instructed in the care and handling of the same,

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especially as to such parts as are easily broken, or the manipulation or use of which is attended with danger. Apprentices must not be allowed to handle arms and ammunition except in the presence of an instructor or a gunner's mate. At the end of a period, all ammunition is to be returned to the armory together with an account of the amount expended. It is to be impressed upon the apprentices that the breaking or loss of parts of ordnance, especially in the case of small arms, occurs even when the greatest care is taken, and that they must report the fact as soon as it comes to their notice. At the end of the period the instructor will inspect such parts of the ordnance outfit as have been used and see that they are returned to their proper places before he dismisses the apprentices under his charge.

The Arrangement of a Class for instruction should be such that all may see and hear what is being explained. The various divisions of a class should be separated sufficiently so as not to interfere with one another. The crowding around the instructor by a few to the disadvantage of the remainder of a class should not be permitted.

Periods.—It is expected that only about one half of the time in a period will be required for the instruction as laid down. An opportunity should then be given apprentices to ask questions relating to the instruction just given. The remainder of the period is to be devoted to asking the apprentices in turn such questions at will bring out and impress upon their minds the more important points of the day's instruction. Apprentices are to be encouraged to ask questions both during and outside of periods.

Blackboards are to be used whenever practicable, to illustrate the instruction.

Instructors should preserve order and report all cases of inaptitude, inattention, or misconduct during their periods of instruction. Apprentices creating a serious disturbance should be sent at once to the office of the officer of the day, and a report of the details of the case should be made at the end of the period. Apprentices showing special aptitude or zeal in gunnery should be so reported for favorable consideration when promotions are about to be made.

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When practicable, make use of the apprentices showing special aptitude by having them assist in the instruction of the more backward in the same class.

This book of instructions should be kept at hand where reference to it can easily be made.

Instructors must bear in mind that the interest and zeal which they themselves show at drills and instruction has the greatest influence in arousing and maintaining interest among the apprentices. While the health and contentment of the apprentices are the first consideration, it is necessary to have them become interested before the results of the instruction given will be of much value.

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No. 1.

GENERAL DESCRIPTION OF ORDNANCE.

Preparation.—Provide a blackboard, a breechblock of 1-pounder Hotchkiss R. F. G., a cartridge for 4-inch R. F. G., a blue print of a B. L. R., and a field gun. Refer to these in the way of explanation whenever practicable during instruction. Read pages 27 and 37, "Ingersoll's Gunnery," 1894.

Instruction.—The whole object of a navy is to shoot guns if occasion demands it. **Naval Gunnery** deals with the proper care and handling of such guns as are found on board men-of-war, so that when it becomes necessary to use them in battle the greatest number of well-aimed shots may be fired in the least possible time. In order to learn gunnery it is necessary to know something about **ordnance,** which is the general term applied to all the fighting material. A study of ordnance would include the designing and construction of guns, with their mounts, ammunition, and tools for working them. For the present it is intended to teach such parts of ordnance as will make gunnery easier to learn. First of all it becomes necessary to learn the correct names of the principal parts of the ordnance outfit, so that the instruction which follows may be understood.

A Gun is a machine intended to throw projectiles long distances with great accuracy. Various means have been used to obtain the great force required to do this, such as compressed air in the pneumatic guns on board the *Vesuvius*, but unless mention is made of something else, a gun is considered to use charges of powder. **Piece** has the same meaning as gun. Point out or explain the following terms: Breech, muzzle, bore, chase, trunnions, smoothbore, and rifling.

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The Caliber of a gun is the diameter of the bore. With ordinary rifling the diameter is measured across the lands; with rib rifling, from the bottom of the grooves.

The Length of guns is usually expressed in calibers. Thus a 6-inch gun of 40 calibers, would mean that the length of the gun is 40 times the caliber of the bore—6 inches—which is 20 feet.

The Main Battery on board ship consists of all guns of 4-inch and greater caliber. The secondary battery consists of all R. F. G. smaller than the 4-inch, and all automatic and machine guns.

Steel B. L. R's.—All modern guns are steel B. L. R's, so called because the loading is done from the breech, and the bore is rifled to cause the projectile to rotate. Cast-iron, wrought-iron, and bronze guns were much used in the past, but steel, as now made, is the best material for gun construction. With the B. L. R. it is necessary to have some efficient means of securely closing the breech to prevent the escape of gas from the burning powder to the rear. Many different breech mechanisms have been invented for this purpose. The interrupted-screw breech plug, fitted with De Bange gas check is used in all B. L. R's of 6-inch caliber and above. In loading B. L. R's the projectile, powder charge, and primer are inserted separately.

In Fixed Ammunition the projectile, powder charge, and primer or cap are combined, by means of a brass case, so that only one operation is required in loading.

A Rapid-fire Gun is a gun having but one barrel and having the powder charge put up in a copper case. The smallest R. F. G. is the 1-pounder, the largest used on board United States ships is of 6-inch caliber. There are various kinds of R. F. G. breech mechanisms, known by the name of their inventors. The ones in use in the U. S. Navy are the Hotchkiss, Driggs-Schroeder, Fletcher, Dashiell, Maxim-Nordenfelt, and Vickers. All of these breech mechanisms are such as to permit of quicker loading and more rapid firing than is possible with the ordinary B. L. R.

Machine Guns are guns which have one or more barrels, which use fixed ammunition, and in which the loading of the gun, the firing, and the ejection of the empty cartridge

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cases are done by machinery. The 37-millimeter Hotchkiss revolving cannon is a type of machine gun in which the mechanism is operated by means of a crank. All the latest machine guns are automatic—that is, the force derived from the recoil of the gun or from the powder gases is made use of to operate the mechanism. The Colt and the Maxim-Nordenfelt 1-pounder are types of automatic machine guns.

Field Guns are R. F. G's of special design, mounted on field carriages for use on shore. On board every man-of-war there are one or more guns of this type for use with landing parties. Machine guns are also used for this purpose.

Boat Guns.—The short 1-pounder R. F. G., and light machine guns, are mounted temporarily on a pedestal in the bows of steam launches and the larger pulling boats carried by naval vessels. When so mounted they are termed boat guns.

Small Arms.—The shoulder rifle and revolver are known as small arms; the ammunition they use is called small-arm ammunition; and the firing is termed small-arm target practice.

Guns are classed according to the mechanism and caliber or weight of projectile. Thus there are 6-inch B. L. R., 6-inch R. F. G., and 6-millimeter rifle, and 1-pounder Maxim-Nordenfelt automatic machine gun.

The mechanism of any gun will seem more simple and be easier to learn if one first looks for the four essential parts which correspond to the trigger, sear, main spring, and hammer of the 1-pounder Hotchkiss R. F. G. The instructor will show the function of each of these four parts, using the breechblock and the blackboard for the purpose.

Gun mounts, ammunition, torpedoes, submarine mines, and armor also come under the head of ordnance.

QUESTIONS.

1. Define ordnance, gunnery, gun, piece.
2. Point out the breech, muzzle, bore, chase, and trunnions.
3. Define caliber. What is rifling?
4. How is the length of guns usually expressed?
5. What guns constitute the main battery? The secondary battery?

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6. What are all modern guns? Why so called?
7. What are the three parts of the ammunition used in B. L. R.?
8. What is fixed ammunition?
9. What is a R. F. G.? The smallest R. F. G.? The largest R. F. G.?
10. What is a machine gun? An automatic gun?
11. What are field guns? Boat guns?
12. What are termed small arms?
13. Explain the following terms: 6-inch B. L. R., 6-inch R. F. G., 6-pounder R. F. G., and 6-millimeter rifle.

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No. 2.

Care in Handling Arms and Ammunition—Care of Ordnance Outfit.

Preparation.—Read "Navy Regulations" (1896), Articles 378, par. 8 and 13; 386, 422, 520, and 774; "Radford's Gunnery" (1898), pages 186 to 190; and "Gun and Torpedo Drills" (1900). Use a R. F. G., the 4-inch if practicable, to illustrate the parts of the gun and mount mentioned in the instruction.

Instruction.—Before being issued to the service, the guns and samples of ammunition are thoroughly tested at the proving grounds, and all parts of the ordnance outfit are most carefully inspected. Accidents that result from the use of guns and in the handling of ammunition are generally due to ignorance or carelessness. Without proper care the guns and ammunition deteriorates, the mechanism will work badly, and the efficiency of the battery is impaired. The instruction which follows is to impress upon apprentices the importance of taking every precaution to prevent accidents and to insure the efficiency of the ordnance outfit. Even with the best of care parts of ordnance will get out of order, be broken or lost; this fact should be reported immediately to the divisional officer or officer of the deck.

Care of the Guns and Mounts.—The frequency and character of the cleaning necessary to keep the main and secondary batteries in prime condition depends upon the nature of the climate and the duty the ship is performing. Instructors will give the substance in "Gun and Torpedo Drills" (1900), adding that, while this is the amount of cleaning that the average ship requires, bad weather and other conditions may make it necessary to do a great deal more. The soft steel of which guns are made is easily scored or burred; only oil, vaseline, and cotton waste or soft rags should be used in

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cleaning the mechanism. All hammering should be done with copper mauls. Emery, brick dust, and gritty substances are not to be used on any part of the mechanism except by trained men to remove rust when ordered to do so. Brass sights are to be kept clean, but should not be polished, as by so doing the marks are made less distinct. In every case of cleaning, fine appearance should be sacrificed to efficiency. In using oil and vaseline light coats should be frequently applied, the previous coats being carefully wiped off. White lead and tallow or a heavy coating of vaseline is used on guns and mounts when preparing for a rough trip at sea, or when circumstances prevent the usual amount of cleaning. No part of the ordnance outfit should be used for other purposes than that for which it was intended. Hanging clothes about the guns, stowing articles away under the gun mounts, and sitting on the guns or gun carriages are not permitted.

Handling Ammunition.—Instructors will explain the provisions for the care and handling of ammunition made by the articles of the Navy Regulations referred to under "Preparation." Ammunition should not be handled unless orders are given to do so. Stray ammunition should be turned into the armory at once. Tampering with ammunition, and especially attempting to separate the parts of fixed ammunition is very dangerous. At general quarters ammunition that seems faulty should be laid aside and the fact reported when opportunity occurs. Frequently it will be found that the fixed ammunition sticks in loading; when this happens wipe the cartridge cases, sponge the chamber of the gun, and push the cartridge home smartly. When fixed ammunition or a shell is dropped a considerable distance, the fact must be reported immediately, as the shock may arm the fuze and make the ammunition dangerous to use. Care should be taken not to bruise cartridge cases, as a dent frequently causes a jam in loading. In fixed ammunition the exposed cap is a source of danger; the greatest care should be taken that the cap of one shell is not struck by the point of another. When using blank cartridges in firing R. F. G. the empty cases should never be returned to a box containing charges; loose powder in the bottom of the box has sometimes been ignited with disastrous results.

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When ammunition is being taken on board or discharged from a ship, all unauthorized lights and fires are extinguished, and a red flag is hoisted at the fore as a warning to other vessels. The ammunition must be handled so as not to dent the powder tanks or injure the charges; the soft copper rotating bands on the projectiles are easily bruised; for this reason mats and swabs should be used to prevent the ammunition striking the deck or hatch coamings. In case the ammunition becomes dirty it must be cleaned before being stowed below.

Detonators and dry primers are especially dangerous. They are stowed above decks or in large compartments as far as practicable from the magazines.

Handling Small Arms.—Whenever taking a rifle or revolver inspect it immediately to see whether it is loaded or not. Even though they are unloaded, always treat small arms as if they were loaded, so that careful handling may become a habit. Never lay down a loaded rifle or revolver; either unload it or keep it in hand. The sights of the Navy rifle are easily broken, and the rifle should not be leaned against a wall, bulkhead, or rail; in case no racks are at hand lay the rifle flat on floor, deck, ground, or across thwarts of a boat. The bolt stop must be kept in its top position to prevent the bolt from coming out Never carry the rifle loaded, except in times of great danger; load just before firing.

QUESTIONS.

1. What are done with guns before they are placed on board ship?
2. How often should the breech mechanism of B. L. R. and R. F. G. be cleaned?
3. How often should the gun mounts receive a general overhauling?
4. What attention should be given daily to recoil cylinders? What before every firing?
5. After firing what cleaning of the gun is necessary?
6. How often should tompions be withdrawn from guns?
7. What materials should be used in cleaning breech mechanisms?

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8. When and by whom, should emory, brick dust, and gritty substances be used?
9. When is a mixture of white lead and tallow used in coating a gun?
10. At General Quarters what should be done with ammunition found to be faulty?
11. What steps should be taken when fixed ammunition sticks in loading?
12. What should be done in case fuzed shell or fixed ammunition is dropped 5 feet or more?
13. What does the red flag hoisted at the fore signify?
14. What should be used on deck and about hatch-coamings to prevent injuring the ammunition?
15. Where are detonators and dry primers stowed?
16. What should be done immediately upon taking a rifle or revolver?
17. How should small arms always be treated? (as if loaded).
18. If no racks are at hand, how dispose of rifle?

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No. 3.

NAVY RIFLE—MECHANISM.

Preparation.—Read "Description and Nomenclature of the U. S. Navy Rifle," pages 1 to 10, and the description of the manipulation of the rifle, pages 13 to 16.

Instructor to provide himself with a rifle, all its attachments, viz: bayonet, belt, sling; two clips of dummy cartridges, and cleaning cord, with a piece of serge 1¼ inches square for cleaner, in recess in butt; also a rifle with stock removed. If practicable, apprentices will provide themselves with rifles.

Name, Caliber, and Weight.—The rifle, now in general use in the U. S. Navy, is known as the "Lee Straight Pull"—so called from the name of its inventor and the action of the breech mechanism, which is opened by drawing the bolt straight to the rear. The caliber (diameter of the bore) is 6 millimeters (0.236 of an inch). Its weight is 8¼ pounds with bayonet unfixed and without sling. The sling weighs ¼ pound and the bayonet ¾ pound.

Krag-Jorgensen.—On account of having a uniform caliber rifle for both the Army and Navy, the Krag-Jorgensen, which was adopted by the Army a few years ago is now being introduced into the Navy, and no more Lee Straight Pull will be made. The Krag-Jorgensen rifle has an entirely different mechanism from the Lee Straight Pull, and its caliber is 0.30 of an inch instead of 6 millimeters.

Nine Principal Parts of the Lee Straight Pull.—The principal parts of the Navy rifle are:

(1) Stock, (2) barrel, (3) receiver, (4) breech mechanism, (5) trigger mechanism, (6) magazine mechanism, (7) rear sight, (8) bayonet, (9) sling. Point to each as named, requiring apprentices to name them in like manner, using the pieces they may have.

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Nomenclature.—In learning the mechanism of a rifle it is necessary to know the names of the parts so as to call them by their proper names. Instructors will take each principal part, name what it consists of as in the preceding paragraph, then explain the function of each part marked with *.

1. Stock.

1. Stock proper.*
2. Barrel cover.*
3. Upper band and bayonet lug.
4. Lower band.
5. Stacking swivel.
6. Sling swivel.
7. Stock swivel-base.
8. Butt-plate slide, button and cavity for cleaning gear—(Cleaning gear in cavity).

2. Barrel.

1. Barrel.*
   (*a*) Chamber.*
   (*b*) Rifling.*
2. Front sight base.
3. Front sight tip and pin.
4. Front sight tip guard.

3. Receiver.

1. Receiver, (*a*) recoil shoulder.
2. Bolt stop.*
   (*a*) Thumb piece.
3. Bolt release.*
4. Firing pin lock.*
5. Lock pin.

4. Breech Mechanism.

1. Bolt.*
2. Firing pin and collar.*
3. Main spring.*
4. Cam lever.*
5. Cam lever handle.*
6. Extractor and spring.*

5. Trigger Mechanism.

1. Trigger* and spring.
2. Sear and spring.
3. Sear fly.

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6. Magazine Mechanism.

1. Trigger guard.
2. Magazine.
3. Release ways.*
4. Elevator arm.*
5. Elevator spring.
6. Elevator spring shaft.
7. Follower (stop pin).
8. Follower guides.
9. Clip guide.

7. Rear Sight.

1. Rear sight base.
2. Rear sight leaf (notches).
3. Leaf spring.
4. Slide (catch).

8. Bayonet.

1. Blade.
2. Tang.
3. Guard.
4. Pommel.
5. Grasp scales.
6. Bayonet scabbard.*
   - (*a*) Body.
   - (*b*) Frog.
   - (*c*) Tip.
   - (*d*) Mouth casings.
   - (*e*) Jaws.

9. Sling.

1. Sling.*
2. Securing hook (sleeve).
3. Slide (sleeve).
4. Snap swivel (plunger; latch).
5. Sling strap button.

In explaining the various parts of the mechanism to a class for the first time, avoid going into minute details or giving dimensions. During this period the attention of apprentices should be drawn to the more important parts, a knowledge of which is necessary in the practical use of the rifle.

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After completing the nomenclature, as stated, and the description of the more important parts, explain the manipulation of the mechanism exactly as given in "Description and Nomenclature, U. S. Navy Rifle," pages 13 to 16.

Answer any questions that the apprentices may have to ask concerning the parts of the mechanism just explained; then ask the following questions of the apprentices in turn:

QUESTIONS.

1. What is the name of this rifle? Why so named?
2. What is its caliber in millimeters? What part of an inch is that?
3. What is the weight of the rifle without sling and bayonet? With sling and bayonet fixed?
4. Name the rifle now being introduced into the Navy. Its caliber?
5. Name the nine principal parts of the Lee Straight Pull rifle, pointing to each as they are named.
6. Of what material are the following parts made: Stock, barrel, bolt, and stock fittings?
7. What takes the place of a ramrod? Where is it kept?
8. What system of rifling is used?
9. Point out bolt stop. What is its purpose?
10. Point out bolt release. What is its purpose?
11. Point out firing pin lock. What is its purpose?
12. Take out bolt and name its principal parts.
13. Point out release ways and tell what their function is.
14. Point out elevator arm. What is its use?
15. When the bayonet is unfixed, where is it placed?
16. Point out sling strap, its securing hook, and its snap swivel.
17. Using a clip of dummy cartridges, load and show how the piece should be carried with regard to being loaded when in situation of great danger. How should it be carried at all other times?
18. Before firing, what should you make sure of? (Bolt home, bolt stop up).

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No. 4.

NAVY RIFLE—DISMOUNTING AND ASSEMBLING.

Preparation.—In the "Description and Nomenclature of the U. S. Navy Rifle' read "Dismounting and Assembling," page 16 as far as to "dismount trigger, etc.," and page 18 commencing at "Reassemble bolt" to "Care and Preservation," also sections 4, 8, and 9; pages 6, 7, 8, 11, and 12, describing, respectively, the breech mechanism, bayonet, and sling. Read articles 133, 134, 148, and 149, "Drill Regulations for Infantry and Artillery." Instructor and each apprentice to provide himself with a rifle, with belt, bayonet, and sling.

Instruction.—Remove bolt and dismount breech mechanism. Review the nomenclature of the eight parts of the breech mechanism (bolt, firing pin, mainspring, collar, cam lever, cam-lever handle, extractor, and spring). Explain in detail the various parts of the breech mechanism as given on page 6, as far as the second line of the last paragraph; the description of mainspring and cam lever and last paragraph on page 7, and first two lines of paragraph describing extractor, page 8. Then assemble the breech mechanism and replace bolt in gun. Conform strictly to the instructions laid down for dismounting and assembling, explaining each step. Caution the apprentices not to use undue force in the assembling of the parts. Then each apprentice, sitting on floor, will dismount and assemble the breech mechanism of his piece, following the movements of the instructor. Have the class repeat this until each apprentice thoroughly understands how it is done.

Sling.—Following the instructions on page 18, show how to (1) remove the sling, (2) attach the sling, and (3) prepare strap for slinging the gun. As far as it may be necessary in

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preparing strap for slinging, conform to positions given in articles 148 and 149, "Drill Regulations for Infantry and Artillery." Then the class, formed in single rank, will remove the sling, attach the sling, and prepare strap for slinging the gun, following the movements of the instructor. Repeat until each apprentice thoroughly understands how to do them.

Bayonet.—Name the parts of the bayonet and bayonet scabbard, explaining the function of the catch. Fix and unfix bayonets, conforming to the positions required by articles 133 and 134, "Drill Regulations for Infantry and Artillery." On board cruising ships the gunner's mates, acting as armorers, attend to all dismounting and assembling of the mechanism, except the bolt and other moving parts, which in the nomenclature are designated as the "breech mechanism." No attempt is made to have every apprentice dismount and assemble the entire gun; first classmen showing special aptitude in gunnery will be taught how to do this.

QUESTIONS.

Answer such questions as the apprentices may have to ask regarding instruction just given, then ask them the following questions:

1. Remove the bolt, stating each step taken.
2. Dismount the breech mechanism and name each of the eight parts.
3. Assemble the breech mechanism.
4. Assemble extractor and spring and replace bolt in receiver.
5. Remove sling from gun.
6. Attach sling to gun.
7. When gun is carried unslung, how is the sling arranged?
8. Prepare for slinging the gun.
9. Sling arms.
10. Name the parts of the bayonet.
11. Fix bayonets; unfix bayonets.
12. What is the function of the bayonet catch?

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No. 5.

NAVY RIFLE—CARE AND PRESERVATION.

Preparation.—Read "Care and Preservation" pages 18 to 20, and description of cleaning cord, page 12, of "Description and Nomenclature of the Navy Rifle." Instructors provide themselves with rifles, having cleaning cords, and cleaning cloths 1½ inches square in cavity in stock, also with a ramrod such as used in armories.

Instruction.—Name the parts of the cleaning cord. The cleaning cloth should be of serge and not larger than 1½ inches square, on account of the small caliber of the rifle. Show how to use cleaning cord, with bolt in gun and with bolt removed; also how to use ramrod, which must never be thrust into the muzzle of the gun. All cleaning must be done from the breech to prevent scoring of rifling near the muzzle.

The cleaning required to keep a rifle in good condition consists of (1) a careful cleaning of the bore with the cord and oily cloths, carried in butt, immeditely upon the completion of the day's firing. This cleaning to be done at the rifle range. (2) A thorough cleaning of the bore, chamber, and mechanism with oily cloths, waste and brushes upon being returned to the armory. The residue left by the smokeless powder should be entirely removed, using fresh water and a solution of soda if necessary. The bore, after being cleaned, should be dried, and then lightly oiled. The chamber must be only very lightly oiled, and should be wiped out before firing. The bolt should be removed for the cleaning in the armory; in case a primer is pierced it will be necessary to dismount the bolt mechanism and clean and oil the main spring, firing pin, and the cavity. Such other cleaning and oiling as may be needed can be done without any further dismounting of the mechanism. Further dismounting will only be required in case of broken parts.

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(3) A general cleaning and oiling whenever there are indications of rust. Rifles seldom used for firing should be inspected frequently for signs of rust, which forms quickly wherever the oil is rubbed off, or the guns are exposed to salt air. With the rifle, as with other parts of ordnance, the coating of oil should be very light, as it catches dust and dirt, which clogs the mechanism, causing it to work stiffly. If in cleaning, cloth or waste becomes jammed in the bore so that it can not be removed with a ramrod, it will be necessary to drill it out. Attempting to fire it out will probably ruin the barrel. For the same reason small wads of waste or other material used to keep dust or dampness out of bore should be removed before firing.

Care in Handling.—The sights are easily broken and every precaution should be taken that they are not injured. If no rack is at hand, nor arm curtains provided, the gun should be laid flat on the floor, deck, ground, or thwarts of a boat. Leaning the rifle against a wall, rail or bulkhead is not permitted. In the manual of arms when coming to the "order" the butt should be eased down to the ground or deck as the hollow stock is easily broken. During the Spanish war many bolts were lost out of the rifles by failure to have the bolt stop drawn entirely up. When rifles are taken from a rack they should be inspected to see that the stop bolt is in its top position; this should always be done before firing. Otherwise the extractor and possibly the bolt may be lost. At all times, upon taking a rifle, it must be inspected immediately to be sure it is not loaded. Even after the inspection the rifle must, as far as practicable, be treated as though it were loaded. When through firing or drill, snap the piece by pulling the trigger in order to relieve the main spring; this should always be done before returning rifles to the armory or to the racks. Every precaution should be taken to keep sand, grit, and salt water out of bore and mechanism.

QUESTIONS.

1. Name the four parts of the cord cleaner.
2. Show how it is used to clean the bore; how to clean the chamber.

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3. From which end of barrel should a ramrod be used?
4. Why should all cleaning of the bore be done from the breech?
5. What cleaning of rifle is required during the course of a day's firing?
6. What cleaning of rifle is required as soon as possible after a day's firing?
7. What cleaning of rifle is required when rifle is returned to armory after firing?
8. What cleaning is required in case a primer is pierced?
9. How should a rifle be disposed of in case there are no racks at hand? Why?
10. Upon taking a rifle, what two parts should be inspected?
11. Why should rifle be eased down in coming to an "order"?
12. In case cleaning gear becomes jammed in bore, how remove it?
13. How should a rifle be handled at all times? (As though it were loaded.)

If time permits, review the questions on "Rifle—Mechanism" and "Dismounting and Assembling."

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No. 6.

INSTRUCTION IN THE USE OF SIGHTS.

Preparation.—Read pages 33 to 39 and 141 to 153, "Radford's Gunnery" (1898); pages 10 and 11, "Description of Navy Rifle" (1895); pages 184 to 187, "Firing Regulations for Small Arms, U. S. Army" (1898); and pages 235 to 240, "Ingersoll's Gunnery" (1894). Provide blackboard and a Navy rifle. Be prepared to make sketches of sights and of trajectory to illustrate the instruction.

Instruction.—The ship or fleet that fires the greatest number of well-aimed shots will generally win the battle, as did the "Kearsarge" in her fight with the "Alabama." It is evident that quick and accurate aiming of guns is of the greatest importance; gunnery ships are employed at great expense to drill men at sighting guns, and the men qualifying as gun pointers receive much better pay than they would otherwise. At the Training Station and on board ship, prizes are given to those who qualify as marksmen at target practice with small arms. To become a good gun pointer it is necessary to know something of the principles governing the motion of projectiles. **When a gun is fired** the quick-burning powder is transformed into gases of much greater volume than the chamber of the gun; the enormous pressure produced by these expanding gases drives the projectile out of the bore with great force (illustrate by sketch). If the projectile were acted upon by no other force except that due to the expanding gases of the burning powder, it would, after leaving the gun, continue to move in a straight line, at a uniform velocity, until it struck some solid substance (illustrate). The direction in which a projectile is moving when it leaves the gun is called the **line of fire.** The velocity with which a projectile is moving when it leaves the gun is called the **muzzle velocity,** and is expressed in feet per second. The principal forces that

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affect the motion of a projectile after it leaves the gun are (1) the resistance of the air, which reduces the velocity; (2) the force of gravity, which draws the projectile toward the earth; (3) the rifling gives the projectile a rotating motion, which causes the projectile to deviate to the right or left of the line of fire according as the rifling is of right-handed or left-handed twist. This deviation of the projectile due to rifling is called drift. For example, suppose a shell fired with a muzzle velocity of 2,500 foot-seconds from a 6-inch B. L. R. mounted on shore, during the first second of its flight the shell does not travel in the line of fire a distance of 2,500 feet, for the resistance of air reduces the distance to about 2,300 feet; the force of gravity causes the shell to fall about 16 feet below the line of fire; and the drift, due to the right-handed twist of the rifling, is a few feet to right of the line of fire (illustrate). The shell is so shaped that when fired it will offer the least resistance to the air. The action of the force of gravity upon projectiles requires guns to be pointed higher than would otherwise be the case.

Sights are fitted to guns to make the aiming easier and quicker. The ordinary sights consist of a fixed front sight and a movable rear-sight bar graduated to 100 yards. (Use R. F. G. sights to illustrate instruction.) To aim a gun, set the sight bar for the proper range, then train and elevate the gun until the target, the tip of the front sight, and the notch of the rear sight are brought in line. To accustom the eye to see distinctly these three points at the same time requires considerable practice, and it is the principal thing to be learned in aiming guns mounted on shore. For this reason always select some clearly defined object about 2,000 yards distant, sight set at the approximate range; clamp the gun and have the apprentices, in turn, look over the sights and then through the bore, calling their attention to the difference between the **line of sight** and the **line of fire,** which is the allowance made for the effect of the action of gravity and the drift due to rifling.

Wind blowing across the line of fire must be allowed for. This allowance is made either by moving the traversing head of the rear sight to windward or by aiming at a point a little to windward of the target.

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Jump.—There is a slight deflection of the projectile due to slackness in the gun mount which permits the gun to "jump" as the projectile is leaving the bore. This deflection is allowed for in the marking of the sight bar.

At sea quick and accurate aiming is far more difficult than on shore as (1) the rolling and pitching of the ship, (2) the speed of the ship, and (3) the speed of the target have to be considered; and the firing, especially the continuous firing of the guns in the secondary battery is of the nature of snap shooting. Guns of the main battery should be fired at the **end of the roll,** preferably at the end of the roll toward the enemy or target, as for an instant the ship is then steady. The rule for moving the traversing head is against the wind, against the direction the ship is moving, and with the moving target. Nearly all the new guns are fitted with telescopic sights, or other sights which have no arrangement corresponding to the traversing head; with these sights the gun pointer, "at commence firing," must rely upon previous experience in making allowance in aiming, watch the fall of his shots if possible, and correct his aim accordingly.

Show by sketches what is meant by a **medium sight, a fine sight,** and a **full sight.** The medium sight should always be used until considerable experience at target practice has been gained. A fine sight causes the piece to fire lower than when a medium sight is used; a full sight causes it to fire higher. Experience will teach you when fine and full sighting can be used to advantage, as at certain ranges in revolver practice.

Care should be taken to protect the sights from injury and to keep them clean, especially the notch of the rear sight. Inspect them before using the piece to see that they are in proper condition; and before firing make sure that the sights are set at designated range. In the case of prolonged firing at the same range see that they do not slip or jump, as this frequently occurs with sight bars of R. F. G.

Instructors will explain the following terms: Aiming; sighting; pointing; range; point blank; trajectory; projectile; bullet; velocity; muzzle or initial velocity; tumble (shell); rifling; right-handed twist; left-handed twist.

Small-arm Rifle.—Name the parts of the front sight: Base, tip, and sight guard; and of the rear sight: base, leaf,

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leaf spring, slide, and catch. Up to 300 yards the piece is fired point blank, that is, leaf down and slide in rear position. For 500 and 600 yards leaf is down, slide at forward end of leaf. Note the marks 3 and 6 on left side of rear-sight base. For 800 yards and upward the leaf is raised and the slide is pushed up until its upper edge comes to the line, just above which a figure marks the number of hundred yards. Explain thoroughly the marking of the leaf, using sketch. The notches on the side of the leaf permit adjustment for intermediate ranges. The sight is adjusted for medium sighting at all ranges.

Telescopic sights and peep sights will be explained in connection with the instruction of the 4-inch R. F. G. and Driggs-Schroeder 6-pounder R. F. G., respectively.

QUESTIONS.

1. What is the object of having sights on a gun?
2. What four forces have to be considered in fitting sights to a gun? The effect of each?
3. What is the line of sight? The line of fire?
4. Define initial and muzzle velocity? How expressed?
5. Define drift; right-handed twist. When is a shell said to tumble?
6. Define projectile; bullet; aiming; range; point blank.
7. What do the ordinary sights of a gun consist of?
8. Explain how to aim a R. F. G.
9. What four things have to be considered in aiming guns? How do you allow for the effect of wind? Speed of ship? Speed of target?
10. With ship rolling, at what time is it best to fire?
11. What is meant by a medium sight? A fine sight? A full sight?
12. Compared with the medium sight what is the effect of using a fine sight? A full sight?
13. Name the parts of front sight of small-arm rifle. The parts of the rear sight.
14. Show how to set the sights of rifle for 300, 500, 600, 800, 900, and 1,200 yards.

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No. 7.

SIGHTING—POSITION AND AIMING DRILLS.

Preparation.—Read "Description of Navy Rifle," pages 10 and 11 on sights; "Firing Regulations for Small Arms, U. S. Army" (1898) paragraphs 1, 17 to 19, 21 to 43, and 48 to 120; "Infantry Drill Regulations, U. S. Navy" (1898), paragraphs 153, 155, 157, 161, 163 to 165.

For sighting drill provide sighting tripod, with rifle mounted upon it; a sheet of paper about 15 inches square; a small staff carrying a tin disk 2½ inches in diameter, painted white, with a black bull's-eye ½ inch in diameter, center of bull's-eye pierced so that pencil point may be inserted; also a list of apprentices, so that record of this drill may be kept. Not over six apprentices should be selected at one time for the sighting drill, which should be completed for this number in about thirty minutes. Set up tripod in target gallery, or some other well lighted place, at a distance of 30 feet from the paper target.

For position and aiming drills the instructor and apprentices will provide themselves with rifles. Refer to photographs, and sketches in "Firing Regulations, U. S. Army" for proper positions in firing standing, kneeling, sitting down, and lying down. An instructor should not attempt to give this drill to more than 25 apprentices at one time.

Instruction.—The sighting, position, and aiming drills, with the instruction already given, are intended to prepare apprentices for target practice so that neither time nor ammunition will be wasted in the target gallery or rifle range. The exercises as given in the "Firing Regulations" will be strictly followed except as may be noted below. The positions must conform to the Infantry Drill Regulations, U. S. Navy. In order to complete the exercises in the allotted time the medium

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sight only will be used unless the fine and full sighting are expressly provided for in these instructions. Use the term medium sight instead of "half" sight employed in the "Firing Regulations."

Sighting Drill.—Review the nomenclature of the sights of the rifle. Explain what determines the line of sight. Show by sketches on paper medium, fine, and full sighting. The leaf is graduated for medium sighting. Explain the necessity of learning the correct amount of full sight that should be seen through the notch of the rear sight, and of always having the sights present a uniform appearance when aiming. Then with rifle mounted on tripod carry out following exercises:

First Exercise.—Stick a black paster near one corner of sheet of paper. Explain how to bring an object in the line of sight. With the slide adjusted for 300, 600, and 1,200 yard ranges, using first a medium sight, then fine and full sights, aim at the lower edge of the paster. Explain in each case what sight is used, and then direct the apprentices, in succession, to close their left eye, and looking through the notch with their right to carefully notice the relative positions of the bottom edge of the paster, the tip of the front sight and the notch of the rear sight. Explain that a fine sight causes a higher point to be hit, and a full sight a lower point to be hit than if a medium sight was used.

Second Exercise.—Adjust slide for range of 1,000 yards; aim at lower edge of paster, using each variety of sight. Have each apprentice in turn inform instructor in a low voice what kind of sight is taken. Try those who fail to give correct answers until they understand the nature of medium, fine, and full sighting. Call attention that only medium sighting will be used during the remaining exercises. Aim at a point about 2 inches distant from lower edge of paster and have the apprentices, in succession, examine sights and inform instructor how he should move the muzzle of the rifle, up or down and to right or left, in order to bring it on lower edge of paster. Caution the apprentices to place their eye so that the tip of the front sight stands out distinct in the middle of the notch, but the eye should be fixed on the target, not on the front sight.

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Third Exercise.—With sight set for 1,000 yards range, have each apprentice find his triangle of error as laid down in paragraphs 36 to 39, "Firing Regulations." Find if he has a constant error, paragraph 40; and if possible determine the cause of this error, paragraph 41. After explaining to each apprentice the cause of his error, have him go through with the exercise again. Paragraph 41 is important, and should be thoroughly studied and carefully applied in determining the causes of errors in sighting. This exercise will only be given with the sight set at one range. Instead of the fourth exercise of the sighting drill in the "Firing Regulations," explain that the barrel should not be inclined either to the right or left when aiming. Raise the leaf and run the slide up to 1,500 yard mark. The rear notch is raised that distance vertically to allow for the fall of the bullet, due to force of gravity. Turn the barrel to the right 90° so that the leaf is horizontal. Explain that in aiming with the barrel thus inclined the position of the notch is such that it makes an allowance in the horizontal plane instead of the vertical, and the point seen over the sights is to the left of the line of fire, while no allowance is made for the effect of gravity. The result is that the bullet strikes lower and to the right of the point aimed at when the barrel is inclined to the right, and lower and to the left when the barrel is inclined to the left.

Aiming and Position Drills.—Form the squad in single rank; open chamber and inspect to see that all pieces are not loaded. Extend intervals to one pace. Form three sides of a hollow square in case the squad numbers more than fifteen. Explain the object of the drill, paragraphs 50 and 51, "Firing Regulations." Have the squad take the position of "load," "Infantry Drill Regulations, U. S. Navy," paragraph 161 (1). Set sight for 800 yards.

First Exercise—Position.—The instructor will go through the exercise laid down in paragraphs 56, 57, and 58, "Firing Regulations," explaining each step in it. Then have the squad go through the exercise by the numbers several times, following the motions of the instructor. Correct the positions and explain each step again if it is necessary. Then have them go through the exercise ten times without the numbers.

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Watch the motions and positions of each apprentice carefully, correcting every detail if required. (See paragraphs 59, 60, and 61.)

Second Exercise—Aiming.—If not practicable to provide targets according to paragraph 63, select some well-defined distant object for squad to aim at. With squad formed in single rank, one pace intervals, conduct the exercise explained in paragraphs 65 and 66 in the same manner as laid down above for the first exercise. Caution the squad to use a medium sight, and to fix the eye upon the object aimed at, not on the front sight. In correcting the positions, follow out suggestions in paragraphs 68 and 70 to 73.

Third Exercise—Pulling Trigger.—When the squad has acquired the details of the second exercise laid down in paragraphs 75 and 76, giving due consideration to the suggestions in paragraphs 77 to 83.

After having gone through each exercise "by the numbers," give the apprentices a little relaxation by having the odd numbers assist in correcting the positions of the even numbers next to them, and vica versa.

In aiming, the following points should be carefully observed:

1. Right heel 3 inches to right and 6 inches to rear of left heel.
2. Left toe pointing nearly to front; feet forming nearly a square, toes and knees turned in slightly.
3. Knees pressed back, but without stiffness.
4. Body in easy and natural position. Avoid drawing in stomach, raising chest, or bending small of back.
5. Raise the piece slowly with muzzle slightly depressed.
6. Press whole surface of butt firmly against hollow of shoulder.
7. Barrel inclining neither to right nor left.
8. Right elbow at height of shoulder.
9. Left elbow well under rifle and against body.
10. Use right hand to hold piece firmly, the left to bring sights on target.
11. Raise right shoulder slightly.
12. Rest cheek against the stock.
13. Aim with the right eye; the left eye closed.
14. Fix eye on object aimed at, not on front sight.

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15. Always use a medium sight.

16. Hold breath at instant of firing, but not too long.

17 Steady the piece on target before pulling trigger. If very unsteady, come down to "load" and try again.

18. Pull trigger with fore finger by gradually increasing the pressure, not with a jerk.

19. Keep right eye open, and continue to aim a moment after the place is discharged.

Instructors will keep a record of apprentices who show proficiency at the sighting, and aiming and position drills.

The aiming and position drills, kneeling, lying down, and sitting down (paragraphs 84 to 120, "Firing Regulations"), will be given at the second period scheduled for this instruction, or at the same time as part of a class is having gallery target practice.

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No. 8.

NAVY REVOLVER—MECHANISM.

Preparation.—Read "Gun and Torpedo Drills" (1900) on the dismounting and assembling, the manipulation, and the care and preservation of the revolver. Refer to "Notes on Navy Revolver, Models of 1889 and 1895," for nomenclature of the parts. Provide a revolver, its tool box, and a table for use in dismounting and assembling.

Instruction.—This revolver, supplied to all United States ships, is the Colt's double-action navy revolver, of 0.38 caliber, made of steel, except the hard-rubber stock scales; its weight is 2 pounds. It was specially designed for use in the Navy, and is manufactured by the Colt Arms Company, of Hartford, Conn. It is said to have double action, as one pull of the trigger performs the double duty of cocking and firing. It can also be used as a single-action revolver, by drawing the hammer back with the thumb before pulling the trigger. The double action makes it possible to fire more rapidly, but it is less accurate than the single action on account of the heavier trigger pull required for self-cocking The single pull is about 7 pounds, and the double pull about 10 pounds.

The tool box contains a wrench, two screw-drivers, set, large and small drifts, and cleaning rod. The wrench can be used as a hammer for the drifts, if necessary. Where a mallet is needed in dismounting and assembling, use the screw-driver handle, grasping it by the neck and delivering the blow with the butt end. The set is used to set out the end of the ejector rod after the ejector has been screwed on. Call attention to the brief instruction for dismounting the revolver printed in box cover.

Dismounting.—Follow the instructions in "Gun and Torpedo Drills" (1900), dismounting the following parts of the mechanism, removing them in the order named below,

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explain each step, and name each part as it is dismounted. After removing the frame plate point out the three essential parts of the mechanism, viz, trigger, mainspring, and hammer.

1. Stock screw.
2. Stock scales.*
3. Frame-cap screws.
4. Frame cap.*
5. Hand and spring.
6. Mainspring strain screw.*
7. Mainspring* (after disengaging stirrup).
8. Hammer (strut and stirrup).
9. Rebound lever.
10. Cylinder stop bolt.
11. Trigger.*
12. Trigger-locking lever screw.
13. Trigger-locking lever.
14. Crane lock and screw.
15. Cylinder* and crane.*
16. Latch spring pin.
17. Latch* and spring.

Explain that this is the only dismounting required except to replace broken parts. The barrel should not be unscrewed from the frame; pins should not be driven out, nor ejector unscrewed from ejector rod; but show how drifts are used, and how the wrench is used to turn off injector and turn out crane nut, the threads in both cases being left-handed. This leaves the following parts assembled or only partially dismounted, viz:

1. Barrel* and sight.*
2. Frame (trigger guard).*
3. Rebound lever spring.
4. Hammer.*
5. Hammer stirrups.
6. Hammer strut and spring.
7. Crane (nut).
8. Ejector* and ratchet.
9. Ejector rod (head).*
10. Ejector spring.

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Explain the function of each of these parts, directing attention particularly to the parts marked with *, the names of which must be remembered by apprentices.

Assembling.—The parts should be assembled in the reverse order, except that rebound lever and spring should be engaged before cylinder stop bolt is entered; the cylinder stop bolt spring is easily broken or given a set and must be handled carefully. (See correction in "Gun and Torpedo Drills," 1900.)

Action of Mechanism.—Before putting on frame cap explain the working of the mechanism, calling special attention to the following points:

1. Increasing tension of mainspring by means of strain screw.
2. When hammer is rebounded, piece can be fired only by pulling trigger, or breaking the mechanism.
3. Locking of cylinder by cylinder stop bolt after firing, and by safety nib of trigger just before firing.
4. Cylinder can only be revolved by operation of the mechanism or by holding hammer in a position corresponding to halfcock.
5. Trigger-locking lever locks mechanism when cylinder is out, so that piece can not be cocked either by pulling trigger or directly by hand without injuring the mechanism.
6. Action of trigger upon hammer strut, using double action.
7. Action of trigger upon hammer in single action (remove hand to show 6 and 7). Complete the assembling of the revolver. Then explain that cylinder must be latched, and the latching tested, after loading, by pressing on cylinder with fingers of left hand; if securely latched, the cylinder will be found immovable. A heavy double pull indicates that the cylinder is not latched. Select apprentices in turn to dismount and assemble such parts of the mechanism as the instructor may direct, having all the apprentices take some part in doing this. Limit the dismounting to the parts noted above. Require the rest of the class to give strict attention to this part of the instruction.

Care and Preservation.—Instruct the apprentices in the "Hints to Armorers," page 96, "Gunnery Drill Book," explaining that all general cleaning of revolvers is done by

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gunner's mates detailed for the purpose. But during long-continued firing the fouling should be wiped from the face of the cylinder to prevent clogging of the joint between cylinder and barrel. A cloth cleaner should be run through bore after each string of shots at target practice, as a dirty bore materially affects the accuracy of the piece. The snapping of rovolvers, except when ordered at drill, is forbidden.

QUESTIONS.

1. Give name, caliber, and weight of Navy revolver.
2. What is meant by double action? Single action?
3. What advantage is gained by using the double pull?
4. What is the advantage of using the single pull?
5. Name tools used in dismounting and assembling.
6. Dismount stock scales and frame cap.
7. Explain use of mainspring strain screw.
8. Remove hand. Point out the three principal parts of the mechanism.
9. Remove mainspring, hammer, and rebound lever.
10. Remove cylinder stop bolt, trigger, and cylinder and crane.
11. In assembling, what part is most liable to be broken?
12. Assembled parts dismounted.
13. What does heavy double pull indicate?
14. How test latching of cylinder?
15. Name parts pointed at. (Point to parts.)
16. What cleaning is required during target practice?
17. Show how to test working of hammer and strength of mainspring.
18. Show how to test working of trigger, hand and rebound lever.

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No. 9.

NAVY REVOLVER—USE AND DRILL.

Preparation.—Read "Gun and Torpedo Drills" (1900) on the manual for Colt's double-action navy revolver. Provide a revolver and belt for each apprentice.

Instruction.—Form the class in single rank and have all the revolvers examined to be sure there are no stray cartridges in the cylinders, then return the revolvers to the holsters.

Give the first order "Draw" and explain accurately and clearly the proper motions.

The orders to be used are as follows:

Commands.

Draw.
Load.
Pack load.
(Designating object) Aim; fire.
(Designating object) (— shots) Commence firing.
Cease firing.
Unload.
Return.

No orders other than those given in "Gun and Torpedo Drills" (1900) will be used.

Each of the above orders are to be explained carefully first, and, after each explanation, the boys will be drilled until each one is perfectly familiar with all the motions and orders.

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No. 10.

SMALL-ARM AMMUNITION, FUSES, PRIMERS, AND DETONATORS.

Preparation.—The instructor will provide several clips of 6-mm. ammunition; of ball, blank, and dummy cartridges, several cartridge cases and bullets, also specimen boxes of fuses and primers.

Read carefully pages 12, 13, and 20 of the Navy Department's pamphlet, "The U. S. Navy Rifle, 6-mm. Model, 1895," also pages 26, 27, and 28 of the Navy Department's pamphlet, "Description of Ammunition."

Instruction.—Exhibit a ball cartridge and point out the cartridge case, primer, bullet, and cannelure. The cartridge case is made of drawn brass, and has no rim, but is provided with a cannelure in which the nib of the extractor engages.

The primer is similar to those used in 0.45 caliber cartridges. Exhibit a section of a primer and explain its action.

The bullet is of hardened lead with a jacket of cupro-nickeled steel. The weight of the bullet is 135 grains.

The ammunition at present issued to the service is loaded with 33.2 grains of Troisdorf smokeless powder, giving an average velocity of 2,460 feet per second at 60 feet from the muzzle.

The ammunition is furnished to the service in steel clips; five cartridges in a clip, and packed four clips in a box, and fifty boxes in a case.

The clip consists of the clip body and the locking wire. Exhibit a clip and explain its action.

The clips are intended to be used only once, and can not be depended on to work satisfactorily after the first time, consequently the packs must not be tampered with nor the loops turned except in the gun.

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Fuses.—Two general classes of fuses are used with modern projectiles, viz., combination time and percussion, and percussion.

Explain the different parts of the time fuse, pointing out each part from a section of the fuse.

Exhibit each kind of fuse and name and explain the action of all the parts.

Fuses for the larger caliber shells have, in addition to the fulminate cap, a small charge of black powder to insure the ignition of the bursting charge contained in the projectile.

It has been found that a drop of 30 feet upon half-inch steel plating does not arm a Navy base percussion fuse, but a drop of 12 feet upon an armor plate will arm the fuse. Consequently, while under usual conditions, dropping fused shells from a considerable height will not cause their explosion, still it is advisable to take the greatest precaution against dropping them, for they **might** strike a solid piece of steel with sufficient force to explode them.

While ramming a shell home in a gun there is no danger whatever of the shock of a shell bringing up on the compression slope causing the fuse to be armed, for the greatest velocity with which a shell could be rammed home does not equal that due to even a small drop.

Primers.—The primers now in use in the service are either percussion or electric. Percussion primers are issued for all guns. Those used in fixed ammunition are purchased from private manufacturers, while those for the ordinary B. L. guns are made at the torpedo station.

Exhibit the various types of percussion primers and then explain the action.

Electric primers are made for all guns of 4-inch caliber and above.

Exhibit an electric primer and explain how the contact is made and the action of the primer.

Friction primers are only used now with the torpedo-launching tubes.

Give a description of detonators, the purpose for which they are used, and where they are stowed.

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QUESTIONS.

1. Name the different parts of a rifle cartridge.
2. Of what materials are the following parts made: Case, bullet, and jacket?
3. What kind of powder is used?
4. What is its muzzle velocity?
5. How are the cartridges put up?
6. Name the parts of the clip.
7. What kinds of fuzes are used in the service?
8. Explain the action of the Navy time fuse.
9. Name the parts of the Schenkle percussion fuse.
10. What kinds of primers are in use in the service?
11. Describe a percussion primer.
12. Describe an electric primer.
13. Name the guns in which electric primers can be used.
14. For what purpose are friction primers used?
15. For what purpose are detonators used?
16. Where are they stowed?

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No. 11.

1-Pounder Hotchkiss R. F. G.—Mechanism and Drill.

Preparation.—Read "Description of Modern Ordnance in the United States Navy," pages 37 to 43.

The instructor will have one of the 1-pounder Hotchkiss R. F. G. brought to the place of instruction, and will see that the breechblock, sights, all the spare parts, and the accessory box are provided.

Instruction.—The 1-pounder Hotchkiss gun has been made in two designs. The first one, known as Mark I, is designated as light 1-pounders, and the gun proper was made in one piece; but the issue of these guns has been stopped.

The other design, known as Mark II, or heavy 1-pounder, is the one in use throughout the service, and is made in three pieces; the **tube**, extending from the face of the muzzle to the face of the breechblock, comprising the whole length of the bore; the **jacket**, which is shrunk over the rear part of the tube and which carries both the trunnions and breechblock; and, the **locking ring**, which is a screw collar connecting the tube and jacket, and which carries the foresight mass.

The bore is rifled with a uniform right-handed twist in the American guns, and with a left-handed twist in the French guns (the two 1-pounders at this station are French guns and are similar to the Mark I guns).

The breechblock is a square, hollowed, steel block, with rounded corners, moving vertically in guides in a mortise cut completely through the jacket. The front face of the block is perpendicular to the axis of the bore, while the rear face is slightly inclined.

The parts of the mechanism showing on the outside of the breech are the crank handles, rocking shaft, cocking toe, cocking cam, and the stop bolt.

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Point out and explain the use of each of these parts.

The firing mechanism within the breechblock consists of the hammer, firing pin, main spring, stirrup, sear, and sear spring.

The only other movable part is the extractor, but this is not connected with the firing mechanism.

Point out and explain the working of each part, and have the boys dismount and assemble the mechanism.

Explain how the stock is secured to the gun.

Explain the markings on the rear sight bar.

The mount ordinarily used for these guns is a cage stand in which the pivot sets. The same stand is used for Colt automatic 6-mm. guns and Gatling guns, an adapter being used on account of the difference in the size of the pivots.

Show the proper position to be taken while loading the gun, and what care should be taken in pointing the cartridge fair.

Explain the probable cause of cartridges and cases jamming, and what means should be taken to prevent and to remedy the same.

Point out and explain the use of each of the accessories in the box.

At subsequent periods of instruction station gun crews and exercise them with the guns, and especially in replacing supposed broken parts.

(See table under period No. 12.)

QUESTIONS.

1. How are the different types of 1-pounders marked?
2. By what other terms are they distinguished? (Light and heavy.)
3. In the heavy 1-pounders, how many pieces are used in constructing the gun proper?
4. What are the names of the various parts, and how are they arranged?
5. In what part of the gun is the breechblock secured?
6. Are the front and rear faces of the breechblock parallel?
7. Name the parts of the mechanism which are seen on the outside of the gun.

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8. Name the parts of the firing mechanism.
9. Explain the action of the extractor.
10. How is the stock secured to the gun?
11. How is the rear sight bar marked?
12. Remove the mainspring and put in a spare one.
13. What kind of mount is generally used.
14. What should be done when the empty cartridge case is jammed and can not be extracted?

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No. 12.

6-POUNDER HOTCHKISS R. F. G.—MECHANISM AND DRILL.

Preparation.—Read "Description of Modern Ordnance in the United States Navy," pages 43 to 45; also, Radford's "Hand-Book on Naval Gunnery," pages 61 to 73.

The instructor will have the breechblocks placed in the guns, the sights on, and the accessory and spare-part boxes at hand.

Instruction. — The last period having been upon the 1-pounder Hotchkiss, the instructor will call the attention of the apprentices to the similarity of the construction of the two guns and of the mechanism.

The breech mechanism of the Mark II 6-pounders is exactly similar to that of the Mark II 1-pounder.

The following table gives some of the characteristics of the Hotchkiss 1-pounder and 6-pounder R. F. guns in the U. S. naval service:

	1-pounder, light.	1-pounder, heavy.	6-pounder, 40-caliber.	6-pounder, 45-caliber.
Caliber ---------- inches	1.457	1.457	2.244	2.244
Weight ---------- pounds	71	120	810 / 785*	795
Length ---------- inches	33.15	62	97.83	108.86
Length of bore ---------- do	29.13	57.98	89.76	100.98
Twist of rifling ----------	Uniform twist of 6°, or one turn in			29.9 cal.†
Number of grooves ----------	12	12	24	24
Depth of grooves ---------- inches	.0155	.0155	.012	.012
Weight of charge ---------- ounces	2.8	4.9	30	30
Weight of complete round ---------- pounds	1.45	1.65	9.9	9.9
Muzzle velocity ---------- foot-seconds	1319	1800	1818	1870
Steel perforated by steel shell at 500 yards ---------- inches	.73	.93	2.76	2.86
2,000 yards ---------- do	.37	.43	1.56	1.59

* Trunnionless gun.

† The Mark II 6-pounders have a uniform twist of one turn in 25 calibers.

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The recoil mount used with 6-pounder guns consists of a single hydraulic and spring recoil cylinder, which, together with the carriage proper, is rigidly secured to the gun, the free end of the piston being attached to the "slide." The slide, resting on trunnions, gives the vertical motion to the gun.

The instructor will illustrate on a blackboard the interior of the recoil cylinder, and, if practicable, will have a recoil cylinder dismounted.

The liquid used in the recoil cylinders is composed of 80 per cent glycerin and 20 per cent fresh water.

Explain the use of the counter-recoil spring; how the sights are marked and put on.

At subsequent periods of instruction, station guns' crews and exercise the class in replacing supposed broken parts.

QUESTIONS.

1. How many parts are used in the construction of the 6-pounder Hotchkiss R. F. G.?
2. What are the names of the various parts and how are they arranged?
3. How is the rear sight bar marked?
4. What kind of a mount is used for 6-pounders?
5. What is the caliber in inches of this gun?
6. What is the weight of this gun?
7. How many grooves are there in the rifling?
8. What is the twist of the rifling?
9. What is the weight of the charge?
10. What is the weight of the complete round?
11. What is the muzzle velocity?
12. What is the object of having the recoil cylinder?
13. What is the counter-recoil spring?
14. What liquid is used in the recoil cylinder?

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No. 13.

4-INCH R. F. G.—MECHANISM.

Preparation.—The class will be taken to the *Vicksburg*, or wherever there are 4-inch R. F. guns, and the instructor will see that all the appurtenances of the guns are in place.

Read "Description of Modern Ordnance in the United States Navy," pages 3 to 10, also "Radford's Handbook on Naval Gunnery," pages 23 to 29 and 49 to 53.

Instruction.—There are four marks of 4-inch guns, but all are of the same construction, differing only in the form of chamber or of breech mechanism.

The Mark I has the ordinary slotted screw-breech mechanism with De Bange gas check. There are but four guns of this type, Nos. 1, 2, 3 and 6.

The Mark II is a rapid-fire gun, using fixed ammunition and fitted with breech mechanism of the Driggs-Schroeder type. There are only two guns of this type, Nos. 4 and 5.

The Mark III uses the same fixed ammunition as the Mark II gun, and differs from it only in having a slotted-screw mechanism of the Dashiell type. All 4-inch guns from No. 7 upward are of this mark.

Mark IV differs from Mark III in that the gun recoils through the sleeve, and the sleeve and two recoil cylinders are in one piece.

Each gun is composed of five principal parts: Tube, jacket, A hoop, B hoop, and breech plug.

The A hoop is put over the front end of the jacket with a reverse cone, and thus locks the tube into the jacket. The 4-inch guns are trunnionless, being held in the mount by the projecting sides of a bronze sleeve or band that screws on to the gun. The hydraulic recoil cylinder forms a part of this

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sleeve, and, when in place, is directly beneath the gun. This bronze sleeve is not removed in mounting but goes with the gun.

The following is the nomenclature of the Dashiell breech mechanism:

Plug,
Face plate,
Combined collar and tray,
Hand lever,
Rotating rack,
Rotating-rack stud,
Hand grasp,
Translating arm,
Translating-arm pin,
Fulcrum pin,
Hinge pin,
Tray latch,
Tray catch,
Extractor,
Extractor keeper screw,
Extractor lug,
Trigger,
Trigger bracket,
Trigger spring,
Releaser,
Releaser spring,
Firing pin,
Firing-pin spring,
Sleeve for firing pin,
Firing-pin guard,
Cocking lever,
Cocking-lever bracket.

The instructor will point out each of the above parts and will carefully explain its object and how it acts.

If a cartridge case sticks and the extractor will not bring it out, close the plug, pull the extractor as far to the rear as possible, and then (using a screw-driver as a lever) pry the rear end of the extractor toward the center of the breech plug until its forward hook is sprung clear of the rim of the cartridge case. The breech can then be opened and a powerful hand extractor used to bring out the empty case.

These guns are fitted either with bar sights or telescopic sights. The rear bar sight is marked on the left side with ranges up to 7,600 yards, on the front side with degrees of elevation to 15°, and on the right side with times of flight to 20 seconds.

The permanent inclination of the 4-inch sight bar is 2° 45′ to the left, and the rear sight head when at level is 0.1 inch to the left of the front sight; this corrects for drift.

The muzzle velocity given by a full charge of brown powder in the 4-inch gun is 2,000 foot-seconds, and the sights are marked for this velocity.

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4-INCH R. F. G., MARK III.

Weight	pounds	3,400
Length	inches	164
Travel of projectile	do	132.12
Weight of charge (brown powder)	pounds	13.5
Weight of projectile	do	33
Chamber pressure	tons	15
Velocity at—		
Muzzle	foot-seconds	2,000
1,000 yards	do	1,657
2,000 yards	do	1,364
2,500 yards	do	1,246
Steel which shell will perforate at—		
Muzzle	inches	7.2
1,000 yards	do	5.5
2,000 yards	do	4.2
2,500 yards	do	3.7
Weight of fixed ammunition	pounds	58
Number of grooves		30
Twist of rifling	zero to 1 in 25 calibers.	

The following parts of the gun mount are to be pointed out and carefully explained:

Pivot stand, top carriage, oscillating slide, and the combined sleeve and recoil cylinder.

After the class has been thoroughly instructed in the mechanism, etc., of the 4-inch R. F. G., the other periods will be devoted to drill in accordance with the "Gunnery Drill Book," and whenever possible subcaliber practice will be held.

QUESTIONS.

1. What type of 4-inch is used at this station?
2. What kind of breech mechanism is used?
3. Of how many pieces is a 4-inch R. F. G. built up?
4. Point out and name the various parts?
5. Point out and name the principal parts of the breech mechanism.
6. Suppose a cartridge case sticks and the extractor will not bring it out, what should be done?
7. What kind of sights are used?

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8. How are the bar sights marked?
9. How are the telescopic sights marked?
10. What is the muzzle velocity?
11. For what velocity are the sights marked?
12. What is the weight of the projectile?
13. How many grooves are there?
14. What is the twist of the rifling?
15. What are the principal parts of the gun mount?
16. How many men compose a gun crew?
17. What are the duties of No. 1, 2, 3, 4, 5, 6, 7, 8 at the order load?
18. What are the duties of No. 1, 2, 3, 4, 5, 6, 7, 8 at the order point?

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No. 14.

SUB-CALIBER TARGET PRACTICE

WITH

HOTCHKISS 6-POUNDER R. F. G., MOUNTED ON SHORE.

Preparation.—Lay out two small floating targets, of different color, one anchored at 400 yards, the other at 600 yards range, and about 400 yards apart. See that the 6-pounders are ready for use. Provide a box of drill cartridges for each gun, and six boxes of 0.45-caliber ammunition. Provide a bench well in rear of each gun for apprentices not in crew. Prepare list of apprentices, to be used in keeping record of firing. Refresh memory by reading "Gun and Torpedo Drills" (1900), and pages 235–250 "Ingersoll's Ordnance and Gunnery" (1894).

Selection of Crews.—This subcaliber practice is to be carried on in connection with the gallery target practice, and, from the division and class having a period at that instruction, select not over twenty apprentices. Divide them equally between the two guns. Station crews at each gun and a "No. 5" to prepare drill cartridges.

Instruction Preliminary to Firing.—Lay the gun on the target so that the line of sight will bear on the lower edge of the bull's-eye or some other distinctive part of the target, using a **medium sight.** Clamp the gun in that position; and have each of the apprentices look over the sights in order that they may understand their proper use. Before, and, if necessary, during the firing, explain how to make allowance for the effect of wind. Show how to find the range by the establishment of a fork. (See Ingersoll, page 242.)

Important Points.—Particular attention should be given to the following points: Accessory box should be on right of

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gun within easy reach of No. 2. **No. 1** should brace himself firmly with the feet well spread, as though the gun were on board ship; he should keep the gun trained on the target with the trigger lanyard in hand all the time; he should see that the loading is done properly and sight set correctly, but he should not, under any circumstances, assist in loading or touch the sights. He should fire the gun by a steady pull of trigger lanyard—not with a jerk. He should continue to keep his shoulder to the stock until he is relieved or the gun is clamped.

No. 2 should stand close to breech ready to grasp the crank handles the moment the gun is fired. He should close the breech with a snap after the cartridge is pushed in. (See "Gun and Torpedo Drills," 1900.)

No. 3 should always have a cartridge ready to load as soon as breech is opened; he should point the cartridge fairly, being careful not to strike the point against face of chamber, then push it in smartly until the rim brings up against the extractor.

No. 4, in addition to the duties assigned to him by the drill book, will catch the empty drill cartridge as it is extracted, being careful not to let it fall, as the rim is easily burred.

Firing.—Each apprentice, as No. 1, will fire a string of five carefully aimed shots at one of the targets. The probable cause of errors of each shot will be explained. After the fifth shot, order "Cease firing," when the gun will be clamped in position for "secure," and the sight bar lowered. Then order "Change stations;" No. 1 takes his seat at left end of bench, the apprentice at the right end becomes No. 5, the other numbers at the gun advance to the next higher station. Then give range and target to be fired at. Continue until all have in turn fired five shots.

Then a second string of five shots will be fired by each apprentice, shifting from one target to the other frequently as ordered, adjusting the sight for the new range at each change of target. If time permits, a third string of five shots will be fired, under similar conditions as the second string, but with increased rapidity of fire.

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The principal object of this subcaliber practice is to accustom the apprentices to the use of the sights, but the instructors must require all movements in working the guns and handling the ammunition to conform to the regular drill as laid down in the "Gunnery Drill Book."

Record.—The instructors will keep a careful record of the proficiency shown by each apprentice as gun pointers, assigning marks ranging from 0 to 5.

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No. 15.

6-POUNDER DRIGGS-SCHROEDER R. F. G.

Preparation.—Read "Description of Modern Ordnance in the United States Navy," pages 45 to 50; also, Radford's "Handbook on Naval Gunnery," pages 73 to 82.

The instructor will see that the breech blocks are placed in the guns, the sights on, and the accessory and spare part boxes at hand.

Instruction.—The class having already had the instruction on Hotchkiss 6-pounder and 1-pounder guns, it will only be necessary to call attention to the difference in the mechanism of the two types of guns.

These guns use the same ammunition as the corresponding Hotchkiss guns, are of the same general form and construction, and fit the same mounts.

The guns are all built up, consisting of a tube, jacket and hoop, with a breechblock engaging in the jacket.

The breech mechanism, consisting of the breechblock, firing mechanism, and extractors, is fitted in the rear end of the jacket, which forms a housing and protection for it.

The breechblock is a steel block recessed on its underside, and fitted on its upper surface with locking bands and on either side with grooves and guide ways.

The block is held in place by the cam, by a stud and guide pins taking in the side grooves, and, when up, by the upper bands taking in corresponding grooves on the interior of the jacket.

The cam is fitted in the recess in the center of the block, and is mounted on the crank bolt, which, extending through the block and both jaws of the jacket, has attached to its left end the crank handle.

The crank or main bolt does not fit snugly in the block, but works through an elongated opening, which permits the block

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to descend and disengage the bands from the corresponding grooves in the breech.

The instructor will point out and explain the action of the cam, main bolt, firing pin, sear, sear spring, and extractors.

The gun can not be fired before the breech is closed, as the trigger is not in place and the firing pin is not in line.

One of the advantages of this mechanism is, that the piece can be brought to a half or full cock without opening and closing the breech.

The lands and grooves of the rifling of the Driggs-Schroeder guns are the same in number and dimensions as in the Hotchkiss gun, but the twist, instead of being uniform, is increasing, beginning at zero and ending at one turn in 26 calibers. The rifling is right-handed in these guns.

QUESTIONS,

1. In what respect does the Driggs-Schroeder R. F. G. differ from the Hotchkiss R. F. G.?
2. Name the various parts of the breech mechanism.
3. Explain the action of the cam.
4. How many grooves are there in the riflings?
5. What kind of twist is used?
6. Explain the action of the extractors.
7. How many extractors are there?
8. When the breech is closed, how is the block held in place?
9. Why can not the gun be fired until the breechblock is completely closed?
10. How does opening the breech affect the extractor?
11. How is the firing pin fitted?

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No. 16.

B. L. R's OF THE MAIN BATTERY.

Preparation.—Read "Description of Modern Ordnance in the United States Navy," pages 3 and 4, also pages 13 to 31; also, Ingersoll's "Text-book of Ordnance and Gunnery" (1899), pages 34 to 85.

Instruction.—The calibers of B. L. R. guns made are 4-inch, 5-inch, 6-inch, 8-inch, 10-inch, 12-inch, and 13-inch. The system of construction and the methods of manufacture are the same for all these guns. Each gun is built up of a number of forged-steel parts; the 4-inch and 5-inch being composed of a tube, jacket, and two chase hoops, and the larger guns have a third layer of jacket hoops and other chase hoops, in some cases extending to the muzzle. These parts are assembled by shrinkage.

The slotted-screw breech mechanism is used in all these guns, the plug engaging in the jacket of the gun, and the gas check being on the De Bange principle.

The forgings used for these guns are made from open-hearth steel ingots, cast solid, and weighing about twice as much as the finished piece requires. For hoops, and sometimes for jackets and tubes, the ingot is bored and then forged on a mandrel, otherwise it is forged solid.

After boring the piece is rough bored and turned nearly to finished dimensions. The forging is then annealed. After this specimens are cut from the ends and broken in the testing machines, to ascertain if the metal is equal to the required strength.

The finishing and assembling of the forgings is done at the Washington Navy Yard, at the gun factory.

The forgings having all been made, the tube is turned to the finished dimensions; the jacket is turned on the inside to a

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slightly smaller diameter than the outside diameter of the tube, then the tube is set up vertically in the shrinking pit, and the jacket, having been expanded by heat, is lowered down over it and then allowed to cool, when the jacket shrinks fast into its place. Then the jacket hoops and chase hoops are shrunk on in the same manner. The gun is then finish-bored, the chamber is bored out, and the compression slope and gas check slope are reamed out, and the screw box is then threaded, and the exterior is finish-turned.

Whenever, in machining, it is necessary to cut away the marks on a forging (placed there by the inspector who tested and accepted the forging), they are transferred to another part of the piece, so that in the finished gun each part can be identified.

Finally the gun is rifled, the screw-box blanks are cut out, the breech mechanism is fitted, the gun is sighted, and, after proof firing at the proving grounds, is ready for issue to the service.

The number of grooves is always four times the caliber, except for the 4-inch and 5-inch R. F. guns, which have thirty grooves.

The 10-inch, 12-inch, and 13-inch guns have no trunnions; this is also the case with 4-inch, 5-inch, and 6-inch rapid-firing guns, and of the latest model of 8-inch gun.

In place of trunnions the heavy guns are provided with deep, wide scores cut in the forward jacket hoop, allowing heavy gun straps to be used to hold the gun to the saddle of the gun mount. In addition, two rings are shrunk on over the gun cylinder, further to the rear, for two straps, to secure the gun to the rear end of the saddle.

Sights.—The sights of all B. L. R. guns are placed on one side of the gun. In many of the guns now in the service the bar sights are used. The instructor will illustrate on the blackboard how these sights are arranged and show their general shape. But telescopic sights are now being fitted to all guns of 4-inch caliber and up, whether mounted in broadside or in turrets. The sights for all guns are similar to those in use on the 4-inch guns at this station.

For finding the target a set of ordinary sights is fitted to the top of the telescope.

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QUESTIONS.

1. Where are B. L. R.'s for the Navy made?
2. Of what material are they made?
3. How are the various parts put together?
4. What system of gas check is used?
5. How many grooves are there in the 8-inch gun?
6. What is the general rule for finding the number of grooves?
7. What guns have no trunnions?
8. How are these guns secured to the saddle of the gun mount?
9. Where are the sights placed?
10. What kinds of sights are used?
11. Describe briefly a telescopic sight.
12. How is a bar sight marked?
13. What marks can be found on all guns?

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No. 17.

GUNPOWDER, GUN COTTON, AND OTHER EXPLOSIVES.

Preparation.—Read Ingersoll's "Text-book of Ordnance and Gunnery" (1899), pages 209 to 237 and Radford's "Handbook on Naval Gunnery," pages 118 to 124. The instructor will have the box of sample powders at hand to illustrate the instruction.

Instruction.—The explosives now used for all guns and for the bursting charges of shells for ordinary work is gunpowder. The ideal powder is that which would, on ignition of the charge, burn in such a manner that the pressure would rise rather quickly to the maximum allowed, and thereafter maintain that pressure throughout the bore while the projectile is traveling from its seat to the muzzle. Such a powder is called progressive.

The kinds of gunpowder in use to-day are black powder, brown powder, and smokeless powder.

Black Powder.—Is a mixture of charcoal, sulphur, and saltpeter. The use of black powder in the naval service is confined to its employment as secondary or ignition charges, for igniting the main charges.

Brown Powder, also styled from its color, cocoa powder, differs from black powder in the proportions of its ingredients, and has superior ballistic properties. It is a mixture of 15 parts of imperfectly charred wood with 80 parts of saltpeter; a trace, or very small amount of sulphur being added. This mixture is thoroughly ground under edge runners and the dust thus made is formed into regular grains by strong hydraulic pressure.

More saltpeter is employed in the powder for the large calibers than in those for the small. A small amount of sugar (not over 4 per cent) is added, which, in connection

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with the water employed for moistening the mixed ingredients, acts as a cementing agent, binding the particles together and making the grain dense.

Like black powder, brown powder has the disadvantage of producing a large amount of smoke upon discharge and of depositing considerable amounts of residue in the bore, thereby necessitating frequent and careful sponging, which delays the firing.

Smokeless powders derive their name from the fact that they produce little or no smoke on the discharge of the gun. The chief advantage to be derived from their use, however, is that they develop greatly improved ballistic qualities, giving velocities about 25 per cent greater than with brown powder.

Upon firing, the ingredients of black and brown powders are only partly converted into gases, and they leave an unconsumed solid residue in the form of smoke and bore deposit; while in the case of smokeless powder, all the ingredients are transformed into gases, leaving no residue.

Smokeless powder requires careful watching at all times, as, if there are any impurities present, they are liable to show decomposition, which might result in spontaneous combustion, or excessive bore pressures when used in the guns.

The temperature at which smokeless powder ignites (400° F.) is much lower that of black or brown powders, which is about 600° F. The former, however, is much less susceptible to ignition by friction than the latter.

Some of the more important advantages of smokeless powder are: Absence of smoke; leaves no residue; the reduced weight of the charge makes it easier to handle and promotes rapidity of fire; higher velocities, leading to increased range, accuracy, rapidity of flight of projectile, and penetration.

Naval smokeless powder has the same composition for all calibers, from the 13-inch gun to the 6-mm. rifle. The size of the grain varies, however, with the caliber.

It is translucent and of a yellow color. The form of grain for the 6-mm. small arm is the flat rectangular; for all other calibers the multi-perforated cylinder is at present employed.

Explain the manufacture as given on pages 234, 235, and 236 of "Ingersoll's Text-book."

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The only other explosives used in the service are gun cotton and fulminate of mercury.

Gun cotton is used in the warheads of torpedoes and for the explosive charges of mines, and is being tried as a bursting charge for special shells with B. L. R. guns.

Gun cotton is produced by the action of sulphuric and nitric acids on cellulose. In the Navy it is made up in square disks and is stored in the gun-cotton rooms in a wet condition.

A certain number of disks are dried for use as primers, and are stored, a small number in separate places, on the upper deck, and are subject to weekly inspection.

Fulminate of mercury is prepared by dissolving 1 part of mercury in 12 of nitric acid. When the mercury is dissolved, 11 parts of alcohol are added. A brisk action takes place and crystals of fulminate are formed. After a while the vessel is filled with water and the crystals allowed to settle, when it is collected and dried.

When dry it must be handled with the greatest of care, as it will explode by friction or percussion.

When wet it will not explode. Its force is not much greater than that of gunpowder, but it is much more sudden in its action.

QUESTIONS.

1. What kinds of gunpowder are used?
2. What are the ingredients of black powder?
3. For what purposes is black powder used?
4. What are the ingredients of brown powder?
5. For what purposes is brown powder used?
6. How is brown powder issued for use?
7. What great disadvantages has brown powder?
8. What advantages has smokeless powder?
9. Why must smokeless powder be inspected frequently?
10. At what temperature does smokeless powder ignite?
11. At what temperature does brown powder ignite?
12. What shape are the grains of smokeless powder made?
13. What other explosives are used?
14. What is gun cotton?
15. What is fulminate of mercury?
16. For what is fulminate of mercury used?

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No. 18.

PROJECTILES FOR B. L. R's.

Preparation.—Read Ingersoll's "Text-book of Ordnance and Gunnery" (1899), pages 238 to 246 to 248; also Radford's "Handbook of Naval Gunnery," pages 105 to 112 and 116 and 117. Have all the various kinds of projectiles at hand ready for use in illustrating the instruction.

Instruction.—There are three kinds of projectiles, viz: Common shell, armor-piercing shell, and shrapnel.

Common shell is used for all calibers of guns, and are now made of forged or cast steel. They have base plugs of steel, and base fuses are now used exclusively.

A new feature for the 6-inch and heavier calibers is the extractor score near the base of the shell, to allow the shell extractor to take hold in case the gun is to be unloaded.

The bursting charges now supplied are of a fine-grained black powder, called rifle powder; they are no longer placed in burster bags, but are poured into the shell cavity, and well shaken down to get as much powder into the shell as possible.

Armor-piercing shells are used in all guns except the 47-mm. R. C., and do not have bursting charges, except in the case of the 1, 3, and 6 pounder R. F. guns, whose armor-piercing shells are loaded and fused in the same manner as common shell. The weights of armor-piercing shell are the same as the common shell for all calibers.

Armor-piercing shells are made of forged, oil-tempered steel by special process, to make great hardiness of point and toughness of body. It is expected that armor-piercing shell, not loaded, will penetrate into steel armor, not specially hardened, without being broken. There are no sharp angles in the cavity to form lines of weakness.

In order to assist the shell in its attack on hard-faced armor, and to assist in biting into an armor plate, all armor-piercing shells are now fitted with a soft-steel cap. This protects the sharp point of the shell and supports the head on its first impact with face-hardened armor.

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Shrapnel.—Both cast iron and steel shrapnel have been issued for guns from 4 to 8 inches in caliber; but in future only steel shrapnel will be issued.

They are made with comparatively thin walls and with a solid base; the head is nearly hemispherical in shape, is made of cast iron, and is fitted with screw-threads to attach to steel body. A time fuse is screwed into the nose. The central portion consists of a tin case, with a cast-iron base, and the case is filled with iron balls around a central tube of gas pipe. The number of balls in the 4-inch shrapnel is about 270.

The bursting charges are very small, simply enough to crack the wall of the shrapnel.

The **rotating band** for all projectiles is of copper, and is forced into an undercut score on the surface of the projectile, near the base, by hydraulic pressure, after which it is machined to the proper size.

The practice of painting projectiles has been discontinued and hereafter all projectiles will be oiled instead.

Projectiles are marked as follows:

On the base, with the place and year of manufacture, and the material and weight of projectile; on the rotating band, with the initials and stamp of the inspector; material is indicated by the letters C. I. (cast iron), C. S. (cast steel), and F. S. (forged steel); all referring to common shell.

Armor-piercing shells are designated by the letters A. P.

QUESTIONS.

1. What projectiles are used in B. L. R's?
2. Of what material is common shell made?
3. What kind of fuses are now used?
4. What is the extractor score?
5. What kind of powder is used for the bursting charge?
6. What calibers of A. P. shell are made?
7. Do they have bursting charges?
8. For what purpose is the cap put on A. P. shells?
9. Of what material is the cap made?
10. What calibers use shrapnel?
11. Describe a shrapnel.
12. What is the purpose of rotating band?
13. How is it put on the shell?
14. What marks are placed on shells?

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No. 19.

MAXIM AUTOMATIC 1-POUNDER.

Preparation.—Read Radford's "Handbook of Naval Gunnery," pages 249 to 255, also the Department pamphlet on the gun.

The instructor will see that the gun is ready for use, and the spare article and accessory boxes are at hand.

Instruction.—This gun consists of two parts, viz, the recoiling and the nonrecoiling. The recoiling portion is the barrel, the recoil plates, the lock and crank, and the crank handle.

The barrel is provided with trunnions, to which the recoil plates are attached. At the rear end of the recoil plates is the crank with connecting rod, to which the mechanism is secured by means of a bayonet lock.

The shaft of the crank passes through the outside plates; to this shaft are fixed the volute side spring inclosed in a gun-metal box on the left-hand side, and on the right-hand side the roller handle, which, when the lock is closed, rests against the roller attached to the outside plate.

The nonrecoiling part of the gun consists of the casing or frame, the water jacket, and the rear block. The casing is secured to the water jacket and rear block by dovetails.

A hydraulic buffer is fitted to the outer part of the rear block for controlling the recoil.

On the right-hand side of the rear block is the pistol grip holding the trigger, and also a socket for the rear sight.

On the left-hand side of the gun case is the volute spring connected with the crank shaft.

The gun-metal water jacket surrounding the barrel is fitted with three openings—one for receiving the water, one for drawing it off, and the third for letting out the steam. The first two are closed by screw plugs, but the other is always open, and is connected to a system of tubes (one sliding and

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one stationary) which permits the steam to escape, but not the water. The barrel is surrounded by a strong spiral spring which rests between the barrel nut and a seat in the middle of the water jacket.

The gun is supplied with cartridges from a belt which passes through the feed block on the top of the gun from right to left. On the right-hand side of the pistol grip is a safety catch, which prevents the trigger being pulled when the indicator is in its highest position. This catch has two other positions, in one of which the piece can be used only as a single action R. F. G., while the third position is for the automatic action.

Upon firing, the barrel, with the recoil plates and mechanism, and the spiral spring surrounding the barrel is compressed. During the recoil, the crank handle is in contact with the roller, and the curve of the crank handle is so constructed that it is thrown over far enough to bring the mechanism back sufficiently far to extract the empty case from the barrel and a fresh cartridge from the belt. After this the volute spring, which has been compressed by the recoil, closes the mechanism.

To insure the breech being closed before the firing pin is released, there is a safety sear, which, as the firing pin is drawn back by the action of the tumbler, engages with a projection on the upper part of the firing pin, so that the latter can not move forward until the sear is raised.

Weight of gun complete	610 pounds.
Weight of gun, water jacket filled	640 pounds.
Weight of recoil portion	280 pounds.
Weight of nonrecoil portion	330 pounds.
Diameter of bore	1.457 inches (37 mm.).
Diameter of chamber, front end	1.5 inches.
Diameter of chamber, rear end	1.61 inches.
Number of grooves	12.
Width of grooves	0.322.
Width of lands	0.06.
Depth of grooves	0.0155.
Angle of sight bar	2° 20′.
Rate of fire	200 per minute.
Recoil	2¼ inches.

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QUESTIONS.

1. Of what two general parts does the gun consist?
2. What parts compose the recoiling portion?
3. What parts compose the nonrecoiling portion?
4. Where is the barrel spring, and what is its purpose?
5. Where is the volute spring, and what is its purpose?
6. Show the three openings in the water jacket. What are they for?
7. How many cartridges are held in a belt?
8. In what positions can the safety catch be placed?
9. Describe the action of the mechanism.
10. Can a cartridge be fired before the lock is closed?
11. How many grooves are there?
12. What is the rate of fire?
13. How far does the gun recoil?

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No. 20.

MAGAZINES AND SHELL ROOMS.

Preparation.—Read Ingersoll's "Text-book of Ordnance and Gunnery" (1899), pages 248 to 254. Take the class on board the station ship, so that they can be shown where the magazines are located.

Instruction.—All ammunition is stowed in specially constructed rooms, set apart for that purpose alone, and distinguished generally in name by the kind of ammunition stowed in each. Powder charges in cases, and shell charges for unloaded shell, are stowed in **magazines.** The heavier kinds of fixed ammunition are also stowed in magazines separate from powder in cases.

All loaded shells are stowed in **shell rooms,** ammunition for minor caliber rapid-fire guns, and for small arms and machine guns in **fixed ammunition rooms,** and wet gun cotton in the **gun-cotton room.**

These rooms are placed below the protective deck and well below the water line, and are connected by water-tight doors with a handling room from which the charges and shell are hoisted to the guns.

All ammunition rooms are water-tight and are floored with wooden gratings.

In the magazines wooden racks or bins are constructed, separated by alleys, in which the powder cases and fixed ammunition boxes are stowed.

Flooding and Draining.—Magazines, shell rooms, and ammunition rooms are provided with flood cocks, usually one to each room, and with overflow pipes to carry off surplus water, and with drainage cocks at the bottom of the magazines to empty them of water after having been flooded.

Both flood and drainage cocks are fitted to be turned on the berth deck, each having a lever fitted to its spindle for the purpose, distinctly marked, and kept secured by a lock, the key of which is kept among those of the magazines.

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Lighting.—Magazines and other rooms for ammunition are lighted by regulation lamps or electric lights in light boxes, so placed that light will be thrown in each alley of the rooms. Light boxes are separate compartments from these rooms and are opened from the deck or flat above the rooms. They are lined internally with soldered sheets of copper, and have a few inches of water in the bottom whenever the light is lighted. The glazing on the sides toward the magazines is double, the thick plates of glass being somewhat separated from each other, one of which is fixed and the other moveable, to facilitate cleaning.

The powder tanks are made of copper and the 6-inch and 8-inch tanks have rubber gaskets under the lids, the lid being sealed by setting up the handle.

Fixed ammunition is put up in wooden boxes. These boxes are painted as follows, in order to distinguish the different kinds of projectiles:

Armor piercing	All black.
Steel, common	All lead color.
Cast iron, common	All red.
Shrapnel	All white.

QUESTIONS.

1. What is the use of magazines?
2. What is the use of shell rooms?
3. What is the use of fixed ammunition rooms?
4. What is the use of gun-cotton rooms?
5. Where are the rooms located?
6. Is the ammunition passed directly from the magazines to the guns?
7. How are the magazines flooded?
8. How are powder charges stowed?
9. What arrangements are provided for flooding and draining the magazines?
10. Where are the flood-cock keys kept?
11. How are magazines lighted?
12. Are the light boxes placed in the magazines?
13. How are light boxes lined?
14. Of what material are powder tanks made?
15. How is fixed ammunition stowed?
16. How are the boxes marked?

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No. 21.

COLT AUTOMATIC 6-MM. GUN.

Preparation.—Read Radford's "Handbook on Naval Gunnery," pages 257 to 259, also the Department pamphlet on the gun. Have the Colt gun with skeleton frame ready for use, and the spare article and accessory boxes at hand.

Instruction.—This gun is of 6-mm. caliber and is self-operating after the first shot is fired. The gas generated by the explosion of the powder, after being used to force the bullet nearly through the bore of the gun, passes through a small vent, and automatically operates the mechanism, which extracts, loads, fires, and ejects the empty case.

The gun consists of a single barrel, screwed into a receiver. The receiver holds the mechanism, and is cased by sides and bottom plates. The first shot having been fired, the gas passing through the vent, strikes a small piston which is in a gas cylinder that embraces the barrel. The piston and gas lever, to which it is secured, are thrown downward, and describe an arc until stopped by coming in contact with the bottom plate. Retracting springs in tubes return into position the gas lever and piston. By means of connections the motion of the gas lever is transmitted to the slide in the receiver and causes the slide to have a fore-and-aft motion, and this gives the necessary motion to the mechanism, which can be seen through the skeleton frame. A safety device allows of restraining the hammer and keeping the mechanism locked. The spring dog which controls the direction in which the feed wheel rotates can be thrown out of action by means of a knurled button on the side of the receiver, which permits of reversing the feed wheel and withdrawing the feed belt when necessary.

The front sight is a plain leaf similar to that on the small arm. The rear sight is a folding leaf, marked up to an

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extreme range of 2,000 yards. The gun should be sighted with a medium sight. The life of a barrel is about 9,000 rounds.

The gun, as furnished to the service, is seated in a saddle, which may be mounted on a tripod or on a 1-pounder cage stand, with adapter. The ammunition is carried in belts containing 250 cartridges.

The rate of fire is fixed at a medium of 400 shots per minute.

The instructor will explain what is to be done in case of "hang fires" and "miss fires."

With each gun is issued a spare barrel, which has been carefully fitted to the receiver and given the same number as the gun to which it belongs.

QUESTIONS.

1. What is the caliber of this gun?
2. What force is used to operate the mechanism?
3. What are the two principal parts of the piece?
4. What does the receiver contain?
5. Explain the safety device.
6. How can the belt be withdrawn?
7. What kind of sights are used?
8. How is the gun mounted?
9. What is the rate of fire?
10. How many cartridges are contained in each belt?
11. What should be done in case a cartridge hangs fire?

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No. 22.

3-INCH RAPID-FIRE FIELD GUN.

Preparation.—Read Department's pamphlet "Description of Fletcher Rapid-Fire Breech Mechanism." See that the 3-inch guns are ready for use and that the accessory and spare part boxes are at hand.

Instruction.—The 3-inch gun constructed for landing purposes is a rapid-fire gun with Fletcher breech mechanism, and using fixed ammunition.

The breech mechanism differs from that fitted to larger guns in having a special percussion firing attachment which holds the lever fast to the breech when the plug is closed, so as to prevent the pull on the firing lanyard from starting the plug open. The type of firing attachment in which the firing-pin is pulled back by the lanyard and snaps off automatically when it reaches the full-cock position, is, of course, only applicable to guns used on shore, where there is no movement of the gun platform, and where it is not important to minimize the interval from the pull of the lanyard to the explosion of the charge.

The ammunition of the 3-inch field gun consists of a short brass case, primed with the same primers as are used in the 1, 3, and 6 pounder cases, and of a shrapnel with combination time and percussion fuse. The charge is about 400 grains of smokeless powder, giving a muzzle velocity of about 1,250 foot-seconds. The shrapnel weighs 13¼ pounds when loaded and fused. Shrapnel is the only projectile supplied for the field gun. On shore the percussion action gives fairly good results. When shrapnel is used for battering purposes, the fuses should either not be cut or should be set at the safety mark.

The 3-inch ammunition is stowed on board ship in boxes containing 17 rounds each. Thirty-two rounds are carried on the field carriage, in four boxes, two on a side.

The weight of the 3-inch gun, including the field-recoil cylinder which surrounds it, is 530 pounds.

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QUESTIONS.

1. What breech mechanism has the 3-inch field gun?
2. How does it differ from the mechanism of the larger calibers?
3. Describe the action of the firing attachment.
4. Can this gun be used on board ship?
5. Describe the ammunition used.
6. What kind of projectile is used?
7. What is the muzzle velocity.
8. What does the projectile weigh?
9. How is the ammunition stowed on board ship?
10. How many rounds are carried on the field carriage?
11. What is the weight of the gun?

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No. 23.

HEMORRHAGE AND THE APPLICATION OF THE TOURNIQUET,

(Bleeding and the control thereof.)

The term "hemorrhage" is applied to a flow of blood from any part of the vascular system, with or without rupture of the vessels, but here we have to deal expressly with bleeding from ruptured wounds, generally incident to rifle ball or cut by bayonet thrust.

The most serious bleeding which we have to consider comes from the rupture or division of one of the large trunk blood vessels like one of the large arteries or veins, and to stop this dangerous loss of blood the vessel should be compressed in its course; in trying to find the course of an artery we will remember that all large vessels lie on the inner side of the extremities, that is, the main artery of the arm will be found on the inner surface of the arm from the armpit to the elbow, and the main artery for the lower extremities on the inner side of the thigh, and that it is always best to make the pressure over the main trunk of the vessel.

The principal hemorrhages are divided into two classes, known as arterial and venous. Arterial hemorrhage is often attended with serious consequences and is readily recognized; the blood is of bright scarlet color, and is forced out in successive spurts, each spurt regular with the movements of the heart. This characteristic spurting is caused by the intermittent force-pump action of the heart driving out the blood into the vessels. Venous hemorrhage is distinguished from arterial by the dark-blue color of its blood, which never comes in intermittent spurts, but oozes from the wounded surface. Venous blood is travelling toward the heart, and there is consequently no force behind to cause a more rapid flow. This form of hemorrhage is comparatively harmless, unless occurring from very large veins.

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Of all the methods for the control of hemorrhage there is none more efficient or available than pressure, and the easiest way of securing this is generally by means of what is called a field tourniquet which is applied in the following manner: A handkerchief is passed loosely around the limb above the wound, and its ends fastened together; a small block of wood, a folded towel, or any substance from which a firm pad may be extemporized, is placed over the artery and under the handkerchief encircling the limb; a stick measuring five or six inches in length is then passed under the handkerchief at right angles, and twisted around until the pad compresses the artery firmly; turning the stick draws the handkerchief very tightly around the limb and over the artery, so that it is thoroughly secured.

Bleeding from the upper extremity at any point below the armpit may be temporarily suppressed by placing a piece of wood an inch and a half to two inches long and the same thickness under the arm well up into the armpit, at right angles to the body, and then pressing the arm firmly against the chest wall, or by pressing the artery firmly with the fingers against the long bone running from the shoulder to the elbow. When the wound is situated below the kneejoint the bleeding may be diminished by raising the limb and placing it on the back of a chair so that the pressure will be made in the space back of the knee; the weight of the limb is generally sufficient to close the artery in this locality but in some cases it may be necessary to fold a towel and place it behind the knee between the chair and the limb. In wounds of the palm of the hand it will be expedient to pad or compress it in the opening, filling up the entire hollow of the palm, and bandage firmly.

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No. 24.

PROTECTION OF SHIPS.

Preparation.—Read Ingersoll's "Text-book of Ordnance and Gunnery," (1899), pages 255 to 274; also Radford's "Handbook on Naval Gunnery," pages 207 to 213.

Instruction.—This period is not intended as a detailed description of all kinds of armor, but simply to give the apprentices a general idea of what is meant by the various terms armor plates, belts of water excluding material, gun shields, armored conning towers and coal protection.

All vessels of the United States Navy which carry armor use steel armor with the exception of the *Miantonomah*, which has compound armor.

Nickel-steel armor is an alloy of steel with about 5 per cent of nickel. This produces a metal of great ductility and toughness with extraordinary resistance to cracking.

Most of the armor now in use has been treated with a Harvey process, which hardens the face of the plate. The latest process is called the Krupp process, and is a secret. The rights of this process have been purchased by the Bethlehem Iron Company and the Carnegie Steel Company. The Krupp armor is guaranteed to have 25 per cent greater efficiency than the Harvey plates.

Corn-pith cellulose is used for water-excluding belts near the water line, but this is not fitted to all vessels.

Good protection against the fire of medium caliber guns has been obtained for the engines and boilers by placing loose coal in bunkers outboard and above the protective deck. Two feet of coal is equivalent to about 1 inch of iron.

Splinter bulkheads are fitted between the guns of the broadside battery of some battle ships.

All ships are divided into numerous water-tight compartments, which would limit the area flooded in case the vessel's side is penetrated.

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The periods allotted to this department during each week are as follows:

	First period.	Second period.	Third period.	Fourth period.
Monday		Third class	First class	Second class.
Tuesday	Third class		First class	Second class.
Wednesday	Second class		First class	Third class.
Thursday	First class		Second class	
Friday			Third class	First class.

The following is the schedule of instruction, the numbers referring to the various periods:

Schedule of Instruction.

First division	1	2	3	4	5	6	7	8	9	10	11	12
Second division	1	2	3	4	5	6	7	8	9	10	11	12
Third division	1	2	3	4	5	6	7	8	9	10	11	12
Fourth division	1	2	3	4	5	6	7	8	9	10	11	12
First division	12	13	14	15	16	17	18	14	19	19	20	21
Second division	12	13	14	15	16	17	18	14	19	19	20	21
Third division	12	13	14	15	16	17	18	14	19	19	20	21
Fourth division	12	13	14	15	16	17	18	14	19	19	20	21
First division	21	22	14	13	23	24	10	12	13	14	16	20
Second division	21	22	14	13	23	24	10	12	13	14	16	20
Third division	21	22	14	13	23	24	10	12	13	14	16	20
Fourth division	21	22	14	13	23	24	10	12	13	14	16	20

An accurate record, showing each period which each division has finished, shall be kept, and the instruction must proceed according to the schedule. If for any reason a division is absent from gunnery instruction on the day they should have have had, say period 18, they must have that period at the next instruction, and not period 19 until No. 18 has been finished.

The instruction for the second three months will be a repetition of the above schedule, with such advanced details as the head of the department may direct.

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TARGET PRACTICE.

Preliminary.—As soon as apprentices have been thoroughly instructed in the mechanism of the service rifle, its care and preservation, they will be instructed in the use of the sights and given the sighting and position drills.

These drills must be thorough in every detail, and the apprentices must understand what is required at target practices, so that the rifle and revolver practice with cartridges may be carried on without any delay or unnecessary expenditure of ammunition.

GALLERY TARGET PRACTICE.

This follows the preliminary instruction, and is intended to give the apprentices an idea of target practice and to overcome the tendency to flinch when pulling the trigger before going to the rifle range. There is no allowance of ammunition for gallery practice, and the boys will fire in turn until they score 12 out of 25. Apprentices making low scores will be carefully questioned to ascertain if they understand the use of the sights.

RIFLE TARGET PRACTICE.

Practice at the rifle range will begin as soon as the boys "qualify" at the gallery practice. The preliminary rifle practice will consist of five shots at each range (100, 200, and 300 yards) in one day, if practicable. Each shot will be marked as soon as fired, and the probable cause of errors explained.

As soon as a class has finished the preliminary firing the record practice will begin. The record rifle practice will consist of a string of five shots at each range, fired within a period of two minutes, for each boy. At the 100 and 200 yard ranges, no artificial rest will be allowed; at 300 yards an artificial rest may be used.

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Revolver target practice will be held by classes in connection with the rifle practice. The preliminary revolver practice will consist of six shots at each range (20, 30, and 40 yards), each shot being marked as soon as fired, and the probable cause of errors explained.

When a class has finished with the preliminary revolver firing, the record practice will begin. The record revolver practice will consist of a string of six shots each quarter at 30 yards' range, without artificial rest, to be fired within one and one-half minutes.

The targets used at all the firings, both with rifle and revolver, will be the "Army A Target." For gallery practice a target one-sixth the size of the "A" target will be used.

Prizes for record target practice.

Mark on the enlistment record.	Qualifies as marksman.	Combined score, rifle and revolver.	Prize.
		80	$1.50
		65	1.00
5.0	First class	50	.50
4.5	Second class		
4.0	Third class	35	None.
3.5	Fourth class	Below 35	None.
Divide score by 10	Not qualified		

The apprentice having the highest score each quarter will be paid $1 additional in prize money, if he has qualified as a first-class marksman.

Each quarter the five apprentices having the highest scores for record firing will compete at one time for the marksmanship medal. But the original record firing scores will be the ones used in paying the regular prize money and for entering the marks on these apprentices' enlistment records.

No boy shall receive more than one marksmanship medal while at the station.

Boys who have qualified as first and second marksmen will be given an opportunity to practice at trap shooting, when practicable.

TARGET RANGE REGULATIONS, 1893.

The master-at-arms of the range is to have charge of the firing party and keep the score.

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He is to detail two of the party at a time to go inside the shelter as markers.

A bugler is to accompany the firing party.

The call "Commence firing" is the notice to those posted inside the shelter that the firing is about to begin.

The call "Cease firing" is the notice to those posted inside the shelter that all danger is over and that they can with safety come out.

If at any time during target practice "Cease firing" is sounded, the danger signal is to be at once shown above the the shelter, and kept up until the markers are again inside the shelter and have assured themselves that the doors to the shelter are properly closed and fastened.

"Commence firing" must never be sounded while the danger signal is in sight.

At any time when the danger signal is shown from inside the shelter the firing is to be stopped, and when stopped the bugle will sound "Cease firing." The markers inside the shelter are on no account to open the doors until this call has has been sounded.

SCORE.

As each shot is fired a marker will signal (being careful to place the center of the disk over the shot hole) the result of the shot to the firing party, as follows:

If a bull's-eye, with a white disk, which scores 5.

If a center, with a red disk, which scores 4.

If an inner, with a black and white disk, which scores 3.

If an outer, with a black disk, which scores 2.

If a ricochet, by waving a disk up and down over the face of the target, and it will be scored "R," but will be considered a zero in adding up the score.

If a miss, by waving a disk over the top of the shelter, which scores 0.

Shots striking the rings and ovals marking the divisions on target shall be credited to the higher score.

When the designated number of shots have been fired at one target, the other target will be shown, and the first will be repaired by placing the pasters over the shot holes.

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The record of the boys' target practice is kept on the following forms:

RIFLE TARGET PRACTICE.

PRELIMINARY.

NAVAL TRAINING STATION, NEWPORT, R. I.

——— *Division.* *Instructor,* ——— *Ammunition expended,* ——— WIND: *Force,* ———; *Direction,* ———

Class.	NAME.	22-CALIBER.										100 YARDS.						200 YARDS.						300 YARDS.					
		50 feet.						100 feet.				1	2	3	4	5	T.	1	2	3	4	5	T.	1	2	3	4	5	T.

REVOLVER TARGET PRACTICE.

PRELIMINARY.

NAME.	20 YARDS.						30 YARDS.						40 YARDS.					
	1	2	3	4	5	6	T.	1	2	3	4	5	6	T.	1	2	3	4	5	6	T.

RECORD.

RIFLE.							REVOLVER.	
	100	200	300	T.			30	
Final.								
Mark on record.								
Order of merit.								

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